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Nimbus/TEC Newsletter



The Nimbus Centre would like to wish all our academic and industry partners a very Happy Christmas and a prosperous New Year.



Water Technology Projects

With its emphasis on Innovation, the Centre has commenced projects with appropriate short- and medium-term goals.

Projects are currently active in:

- Remote supervision of multiple small water treatment sites,
- Viable technologies for treatment of fats, oils & greases (FOGs),
- Seamless workflow management systems for reporting and repair of leakages
- Centralised information acquisition solutions for district metred areas (DMAs)

For more info contact:
kieran.delaney@cit.ie

Cork Institute of Technology and Cork City and County Councils create new Water Technology Group for the Cork Region.

A new Innovation Hub to address Ireland's water infrastructure was launched in the Nimbus Centre, Cork Institute of Technology on Thursday 8th December. The **Water Systems and Services Innovation Centre** (WSSIC) is a joint venture between Cork City Council, Cork County Council and the Nimbus Centre at Cork Institute of Technology. The WSSIC aims to create an expert resource in modernizing Ireland's water infrastructure by taking advantage of Nimbus' technological knowledge and leveraging both Councils' experience in Water Resource Management.

The WSSIC plans to harness state-of-the-art technology in water quality monitoring, leakage reporting & repair, remote monitoring and much more. The resulting innovations will be rolled out across Cork city and county with a view to deploying to all city and county councils in Ireland. With this, the WSSIC will seek to become internationally recognised as a hub for innovation in water-based systems and technologies. Alongside more efficient water services and monitoring processes, the WSSIC will be used as a catalyst for the creation of Irish-based enterprise and jobs.



Standing L-R: Michael Loftus, Head of Faculty of Science & Engineering CIT; Cllr. Tim Lombard, Mayor of the County of Cork; Dr Kieran Delaney, R&D Manager Nimbus Centre; Cllr. Tony Fitzgerald, Deputy Lord Mayor; Ruth Buckley, Head of Information Systems Cork City Council; Jim O'Donovan, Director of Service, Community, Enterprise & Environment Cork City Council; James Fogarty, S/Divisional Manager North Cork; **Seated L-R** Tim Lucey, Cork City Council Manager; Dr Brendan J. Murphy, President CIT; Martin Riordan, Cork County Council Manager.

Nimbus Centre attends Mallow Maths and Science Family Fair

Mallow hosted its first Maths and Science Fair on Sunday 16th October. The event was held to broaden the appeal of maths and science topics, providing many entertaining and informative activities that show these disciplines in action in real life and making the benefits of science and maths more visible and accessible to all.

The event was organised by the National Centre of Excellence in Maths and Science Teaching and Learning (NCE-MSTL) and the Mallow Development Partnership and held at the GAA complex in Mallow. Throughout the afternoon over 2500 people of all ages and from many different parts of North Cork visited the fair, participated in the exhibits and spoke with the many exhibitors who were present.

CIT was represented by the Nimbus Centre and Blackrock Castle Observatory who combined to show innovation projects, including some located in Mallow itself, and the planetarium, which proved a highlight of the day for many.

The Fair was launched by Minister of State, Department of Enterprise, Jobs & Innovation and Department of Education

and Skills Mr Sean Sherlock who spoke about the importance of Maths and Science to economic development and said *'this first community-based Science and Maths Fair brings science and maths out in to a community demonstrating that these subjects are both interesting and entertaining'*.

Michelle Starr, the event organiser, was delighted with the public response. *"Visitors were absolutely enthralled with the event and have explicitly requested for this event to run annually in Mallow"*.

Other participants agree; *"The scale of the response from the public was really encouraging; next time we will need to use a bigger room!"* said Dr Kieran Delaney, R&D Manager for CIT's Nimbus Centre. *"There is clearly a growing recognition in the community of the importance of STEM subjects and this Fair offers a new and effective form of engagement. We are delighted that Nimbus and BCO could support such an event and we see it as the beginning of something that could make a real difference."*

For more info contact
kieran.delaney@cit.ie.

SCUBA Project Kick-off

The Nimbus Centre is acting as Project Coordinator for a new EU FP7 project titled **Scuba: Self-organising, Cooperative, & robust Building Automation**. Large scale embedded Monitoring and Control (M&C) systems in energy management, transportation, security and safety often co-exist alongside each other with little co-operation within and among heterogeneous systems which hampers the increasing demand to operate the whole system optimally. A good example is building management, a market worth in ex-

cess of \$36 billion annually by 2015, where a wide range of vendor specific, heterogeneous M&C systems for HVAC, access control, fire and safety, etc. are in use. SCUBA will create a novel architecture, services, and engineering methodologies for robust, adaptive, self-organising, and cooperating monitoring and control systems. This addresses the current problems of heterogeneity and interoperability, installation and commissioning complexity, and adaptability and robustness in the



Michael Haralambakis and Dave O'Leary at the Mallow Science Fair

Nimbus Seminar Series

The Nimbus Centre has kicked off a series of seminars to give a taster of the type of research and innovation we are involved in.

So far the following seminars have been held:

- Embedded systems for Prognostics and health Management (PHM): An overview of Prognostics and its role in embedded systems research, Dr Liam Moore.
- Optical Chemical Sensors: Using light and chemistry for novel sensing techniques, Dr Ross Gilanders.
- Patents and Commercialisation: from the Research Lab to the SME, Ronan Coleman, Michael Weldon.

For more info contact sinead.rodgers@cit.ie

building monitoring and control space.

For more info contact
dirk.pesch@cit.ie.

Other project partners include Philips Research Labs Netherlands and United Technologies Research Centre Ireland.



Academic News

PhDs awarded to five Nimbus students

We were very proud to see PhD degrees conferred on five Nimbus students in the CIT October graduations: **Amjad Alsakarnah, Berta Carballido, Liam Moore, Rodolfo de Paz and Pawel Rulikowski**. This was the largest grouping of Nimbus doctoral students to receive their degrees to date. Spanning four nationalities and a range of topics, they reflect both the scope of Nimbus research and the diversity of Nimbus researchers. All of the students published in high quality international journals and conferences during their research.

Berta's (supervisors Dr. Dirk Pesch, Dr Susan Rea) thesis was entitled **A Quality of Service Aware Framework for Wireless Sensor Networks in Industrial Environments**. The external examiner, Prof. Gorg from the University of Bremen, highlighted the worthwhile and original contribution that Berta made to the field of quality of service provisioning for industrial wireless sensors networks with a significant number of publications being produced.

Rodolfo's (supervisor Dr. Dirk Pesch) thesis was entitled **Energy Aware Communications Framework for IEEE802.15.4 Wireless Sensor Networks**. In the external examiner's report, Dr Joern Ploennigs of the Technical University of Dresden stated that the work developed a framework for energy-efficient wireless sensor networks in which a series of algorithms was designed, tested, and analysed that seamlessly use existing elements in the IEEE 802.15.4 standard and which adapt and optimize the protocol parameters according to device communication requirements.

Liam's (supervisor Dr. John Barrett) thesis was entitled **Miniature Embedded Module for Prognostic Health Monitoring of Electronic Systems** and focused on a multi-parameter, multi-axial sensing module to monitor the critical reliability parameters of machines, structures and electronic systems parameters in order to collect

data that can be used to prevent failure. The final 1cm³ module, built using a novel 3D packaging process, is the smallest known prognostic module created to date. The external examiner, Prof. Paddy French from Delft Technical University, stated that this work was systematically planned and executed and that clearly the candidate was fully on top of the subject. It is also worth noting that Liam is an example of how CIT's academic ladder system can facilitate progression to the highest level of qualification. Liam began study in CIT's Level 6 Certificate in Electronic Engineering. He then progressed to Diploma, transferred to the Honours Degree in Electronic Engineering and, having worked at Tyndall National Institute, returned to CIT to take up a postgraduate research position in Nimbus, ultimately leading to this award of PhD.

Pawel's (supervisor Dr. John Barrett) thesis was entitled **Ultra Wideband Pulse Shaping** and his original contributions led to three publications in the highest ranked international microwave journals as well as

in a number of international conferences. Indeed, the external examiner, Prof. Thomas Brazil of UCD, commented that the volume and quality of publications was a highly commendable aspect of the work of the candidate. The culmination of this work was the formulation of a novel general technique for "inverse filtering" that enables successful accounting for loss and dispersive effects in the design of non-uniform transmission lines for UWB pulse shaping. Pawel originally came to CIT as an undergraduate Erasmus student and, after graduation in his native Poland, returned to CIT to pursue postgraduate research.

Amjad's (supervisor Dr. John Barrett) thesis was entitled **Protection of Embedded Systems for Applications Involving High Loading Rate Mechanical Forces**. The research investigated methods of protecting embedded modules from high levels of mechanical shock and vibration. Adapting methods used to protect larger scale structures from impacts, it took as a case study the very challenging application of embedding a sensor module in the

slotar used in the Irish sport of hurling. The external examiner, Dr. Denis Kelliher of UCC, commented that the results contribute to our understanding of bat-ball impact interaction generally and are specifically the first such results for hurley-sliotar impact.

Amjad's project is also an excellent example of inter-departmental collaboration as it involved strong interaction with the School of Mechanical and Process Engineering who made both facilities and technical support freely available to him. A further example of such collaboration was the PhD awarded to William Quinn at the October conferring. Bill, under the supervision of Dr. Ger Kelly in the Department of Manufacturing, Biomedical and Facilities Engineering, carried out research in collaboration with Nimbus on embedded sensors for monitoring of concrete strength during curing. Both projects lead to joint publications between the departments.



CIT Conferring Ceremony 2011
Monday 24th October - www.facebook.com/myCIT

The doctoral graduates after their conferring, including the President of CIT, Dr. Brendan Murphy, Vice-President for Academic Affairs, Dr. Barry O Connor, members of the CIT Governing Body and academic staff.

Academic News Continued

Nimbus hosts undergraduate and postgraduate taught modules

Nimbus is strongly committed to the integration of research with teaching and, in addition to the strong postgraduate research programme at Nimbus, the Centre's laboratories and other facilities are available to taught students at both undergraduate and postgraduate levels. Pursuing this policy further, in the Autumn 2011 semester, Nimbus hosted the

delivery of an undergraduate module in Nanoscale Technology and a postgraduate module in Transferrable Research Skills. These were delivered using the teaching facilities included in the design of the Nimbus Centre.

For more info contact john.barrett@cit.ie.

Nimbus supports primary and secondary schools

In the last newsletter, we reported how Nimbus supported Scoil Naomh Fionán national school in winning a national competition in Green Engineering organised by STEPS and Engineers Ireland. This reflects our commitment to encouraging the study and science and technology topics at 1st and 2nd level by directly engaging with students. We also provide support to secondary school students carrying out projects for events such as Young Scientist in topics related to embedded systems. Examples

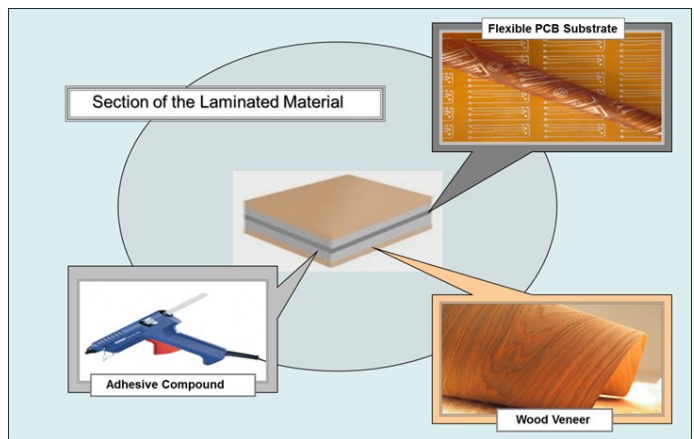
include: support provided to students from Colaiste na Toirbhirte in Bandon in a project on RFID and the support currently being provided to students from Scoil Mhuire in Cork who are working on a very interesting project on energy harvesting by capturing the kinetic energy in rainfall and converting it to electricity using piezoelectric transducers. We encourage students who are planning or working on projects related to sensing, wireless technologies and related areas to contact us.

IQ Veneers Commercialisation Award

Enterprise Ireland presented Dr Kieran Delaney, R&D Manager, Nimbus Centre with an award for his role in the commercialisation of research for the IQ Veneers project. This research project has successfully completed its commercialisation stage which culminated in a license agreement between CIT and Merenda Ltd, Manorhamilton, Co Leitrim. The project resulted in the development of an innovative electronics design and process integration solutions that permit sensor and control subsystems to be directly

and functionally embedded in veneers. Successful implementation of this technology creates convergence of the home and business systems markets, particularly where hidden systems are beneficial (e.g. for security), of markets supporting new services in user spaces (e.g. device recharging surfaces) and drivers for more scalable, eco-friendly systems. Project team included Juan Francisco Martinez, Colin Leslie and Dave Hunt.

For more info contact kieran.delaney@cit.ie.



Section of the laminated material

eGo poster wins prize

The eGo research project was successfully demonstrated at the European Nanoelectronics Forum 2011 in Dublin and won 2nd prize in the exhibition

competition. The eGo project offers an innovative way to establish wireless bidirectional channels of communication between objects and users.

Using signal transmission via the user's body, every eGo-compliant object you touch is "paired" with the eGo device you carry on you, close to your skin. The objective is to enable very intuitive, very simple applications where touching a device turns into a personalization of such a device to install, for example, the user's rights and credentials. "what you touch is yours".

As well as the Nimbus Centre, other Irish project partners include Tyndall National Institute and SMEs, such as Lincor Solutions and Decawave who are working together with other European partners to build prototype demonstration systems based on the eGo concept.

For more info contact kieran.delaney@cit.ie.



Fig 1: Alain Rhélimi (Gemalto) receives 2nd place award on behalf of the eGo consortium.

Fig 2: Eamon Gilmore, Tánaiste & Minister for Foreign Affairs and Trade at eGo Poster exhibit

Fig 3: The Irish eGo Consortium Representatives, L – R Dr Alan Mathewson (Tyndall), Marco Belastro (Tyndall), and Jian Liang (Nimbus, CIT)

Fig 4: eGo prototype demonstrator (Nimbus, Tyndall, Lincor)